PRESYS®



Dry Block Calibrators

TE-1200P

Technical Manual



WARNING!

Avoid electric shock risk on touching the equipment:
- Use only suitable power cable with earth connection;
- Never power the equipment to the mains socket with no earth connection.



WARNING!

High voltage is present inside these equipments. It can cause great damages and injuries.

Do not make any repair service inside the equipment without removing the plug from the supply.



WARNING!

Much electromagnetic noise can cause instability to the equipment.
The equipment is provided with electromagnetic interference filters that protect not only the mains but also the equipment itself against noise. These filters have no function if the unit is not earthed properly.



WARNING!

High temperatures are achieved in these equipments.
Risk of fire and explosion are present in case safety measures are not taken. Sign by means of warnings the hazardous areas at high temperatures.
Do not place the dry-block on inflammable surfaces or even on materials that can be deformed due to high temperatures.
Do not obstruct any air-vent to avoid risk of fire in the equipment.



WARNING!

The instruments described in this technical manual are equipment for use in specialized technical area.
The user is responsible for configuration and selection of values of the parameters of the instruments.
The manufacturer warns against the risk of incidents with injuries to both persons and property, resulting from the incorrect use of the instrument.





WARNING!

Never remove the insert from the dry-block or the thermo-elements from the insert, while they are in temperatures far from the ambient. Wait until they reach the ambient temperature so that the heterogeneous cooling of the parts do not jam each other. If, by chance, it happens a jamming situation, refer to item 6.2 - *Instructions for Insert Jamming* to proceed properly.

CAUTION!

Never switching off the equipment at 1200°C (2192°F).
When the temperature over the block is higher than 1000°C, it is mandatory to lower the block temperature before to switching it off.

CAUTION!

Never store the equipment over 70°C.

CAUTION!

The lifetime of the heating assembly and temperature sensor, may be reduced if operates in extreme temperatures for extended periods.

Disposal calibrator:



NO HOUSEHOLD WASTE!

The calibrator consist of various different materials. It must not be disposed of with household waste.

The warranty conditions are available in our sites:
www.presys.com.br/warranty

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1 - Introduction



TE-1200P

TE-1200P dry block calibrators generate temperature in the insert in order to calibrate thermocouples, RTDs, glass thermometers, thermo-switches. Besides providing high accuracy temperature values, it also allows the measurement of signals generated by the thermo-element which is being calibrated. This is possible due to an embedded calibrator specific for these types of signal, including 4-20 mA. Thus, they incorporate the functions of dry block, standard thermometer and calibrator for RTD, TC and mA.

- TE-1200P calibrator generates temperatures from 50 ºC (122 ºF) to 1200 ºC (2192ºF).

They present a wide variety of programming resources, allowing the performance of automatic calibrations of thermocouples, thermoresistances, thermoswitches. In this case, the sensor is placed in the insert and their electrical terminals are connected to the embedded calibrator. The operator defines the calibration points and the number of repetitions, then the process is started and all the sequence is automatically accomplished.

Another way of performing automatic documented calibrations is by means of the ISOPLAN Calibration Software for PC/Windows™, which uses RS-232 or RS-485 serial communication to the computer. With ISOPLAN it is possible to register sensors and instruments of a factory, generate work orders, create and print calibrations certificates and reports, that is, it brings all advantages of computer data management to the calibration environment.

TE-1200P have also many other features, such as:

- Use of internal standard thermometer.
- Accuracy to 0.1 ºC, stability of 0.02 ºC and resolution of 0.01ºC.
- Engineering units configurable to °C and °F.
- RTD input for 2, 3 and 4 wires.
- Inputs for mA, thermocouples and thermo-switches.
- Thermo-element reading scaled to ITS-90 or IPTS-68.
- Internal regulated 24 VDC power supply for 2-wire transmitters.
- The electric signal calibrator is independent from the dry block function.
- Carry out completely automatic calibrations without the use of a computer.
- Internal buzzer beeps when the temperature reaches the desired value.
- Keypad to ease the operation and configuration of the calibrator.
- OLED Graphic display.
- Independent safety circuit for over-temperature protection.
- Insert to choose, strap and test leads included.
- Optional carrying case.

1.1 - Technical Specifications

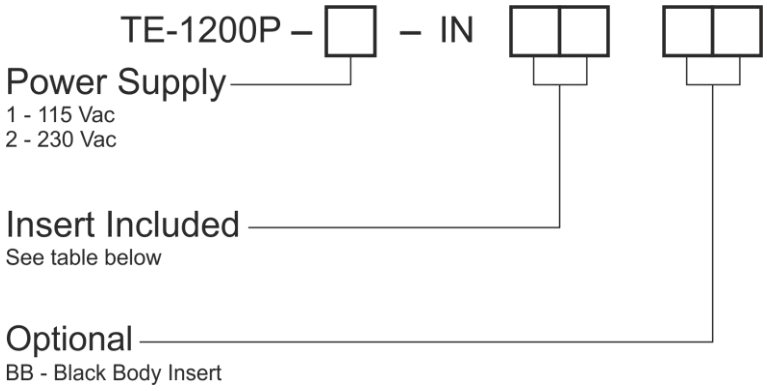
	TE-1200P
Operating Range	50 ºC to 1200 °C
Accuracy with internal Reference:	± 2.2 °C
Resolution	0.1 ºC
Stability	± 0.1 ºC
Radial Uniformity (homogeneity)	± 0.05 ºC @ 50 ºC ± 0.15 ºC @ 650 ºC ± 0.20 ºC @ 1100 ºC With insert IN1C
Axial Uniformity (homogeneity)	± 0.15 ºC @ 50 ºC ± 0.25 ºC @ 650 ºC ± 0.40 ºC @ 1100 ºC With insert IN1C
Heating Time	100 min (100 ºC to 1200 ºC)
Cooling Rate	5 h (1200 ºC to 200 ºC)
Electric Power	800 W
Well Diameter x Depth	∅ 34 mm / 130 mm
Weight:	12 kg
Dimensions (HxWxD):	354,5 x 206 x 318 mm

1.1.1 - Input Technical Specifications

Input Ranges		Resolution	Accuracy	Remarks
millivolt	-150 to 150mV 150 to 2450mV	0.001mV 0.01mV	± 0.01% FS ± 0.02% FS	R_{input} > 10 MΩ auto-ranging
mA	-1 to 24.5mA	0.0001 mA	± 0.02% FS	R_{input} < 160 Ω
Resistance	0 to 400 Ω 400 to 2500 Ω	0.01 Ω 0.01 Ω	± 0.01% FS ± 0.03% FS	excitation current 0.9 mA
Pt-100	-200 to 850 ºC / -328 to 1562 ºF	0.01 ºC / 0.01 ºF	± 0.1 ºC / ± 0.2 ºF	IEC-60751
Pt-1000	-200 to 400 ºC / -328 to 752 ºF	0.1 ºC / 0.1 ºF	± 0.1 ºC / ± 0.2 ºF	IEC-60751
TC-B	-50 to 250 ºC / 122 to 482 ºF 250 to 500 ºC / 482 to 932 ºF 500 to 1200 ºC / 932 to 2192 ºF 1200 to 1820 ºC / 2192 to 3308 ºF	0.1 ºC / 0.1 ºF 0.1 ºC / 0.1 ºF 0.1 ºC / 0.1 ºF 0.1 ºC / 0.1 ºF	± 2.5 ºC / ± 5.0 ºF ± 1.5 ºC / ± 3.0 ºF ± 1.0 ºC / ± 2.0 ºF ± 0.7 ºC / ± 1.4 ºF	IEC-60584 IEC-60584 IEC-60584 IEC-60584
TC-J	-210 to 1200 ºC / -346 to 2192 ºF	0.1 ºC / 0.1 ºF	± 0.2 ºC / ± 0.4 ºF	IEC-60584
TC-K	-270 to -150 ºC / -454 to -238 ºF -150 to 1370 ºC / -238 to 2498 ºF	0.1 ºC / 0.1 ºF 0.1 ºC / 0.1 ºF	± 0.5 ºC / ± 1.0 ºF ± 0.2 ºC / ± 0.4 ºF	IEC-60584 IEC-60584
TC-N	-260 to -200 ºC / -436 to -328 ºF -200 to -20 ºC / -328 to -4 ºF -20 to 1300 ºC / -4 to 2372 ºF	0.1 ºC / 0.1 ºF 0.1 ºC / 0.1 ºF 0.1 ºC / 0.1 ºF	± 1.0 ºC / ± 2.0 ºF ± 0.4 ºC / ± 0.8 ºF ± 0.2 ºC / ± 0.4 ºF	IEC-60584 IEC-60584 IEC-60584
TC-R	-50 to 300 ºC / -58 to -572 ºF 300 to 1760 ºC / 572 to 3200 ºF	0.1 ºC / 0.1 ºF 0.1 ºC / 0.1 ºF	± 1.0 ºC / ± 2.0 ºF ± 0.7 ºC / ± 1.4 ºF	IEC-60584 IEC-60584
TC-S	-50 to 300 ºC / -58 to -572 ºF 300 to 1760 ºC / 572 to 3200 ºF	0.1 ºC / 0.1 ºF 0.1 ºC / 0.1 ºF	± 1.0 ºC / ± 2.0 ºF ± 0.7 ºC / ± 1.4 ºF	IEC-60584 IEC-60584

Accuracy values are valid within one year and ambient temperature range from 20 to 26 ºC. Outside these limits add 0.001 % FS / ºC, taking 23 ºC as the reference temperature. For thermocouples with internal cold junction compensation, add a cold junction compensation error of ± 0.2 ºC or ± 0.4 ºF.

1.2 - Order Code



1.3 - Accessories

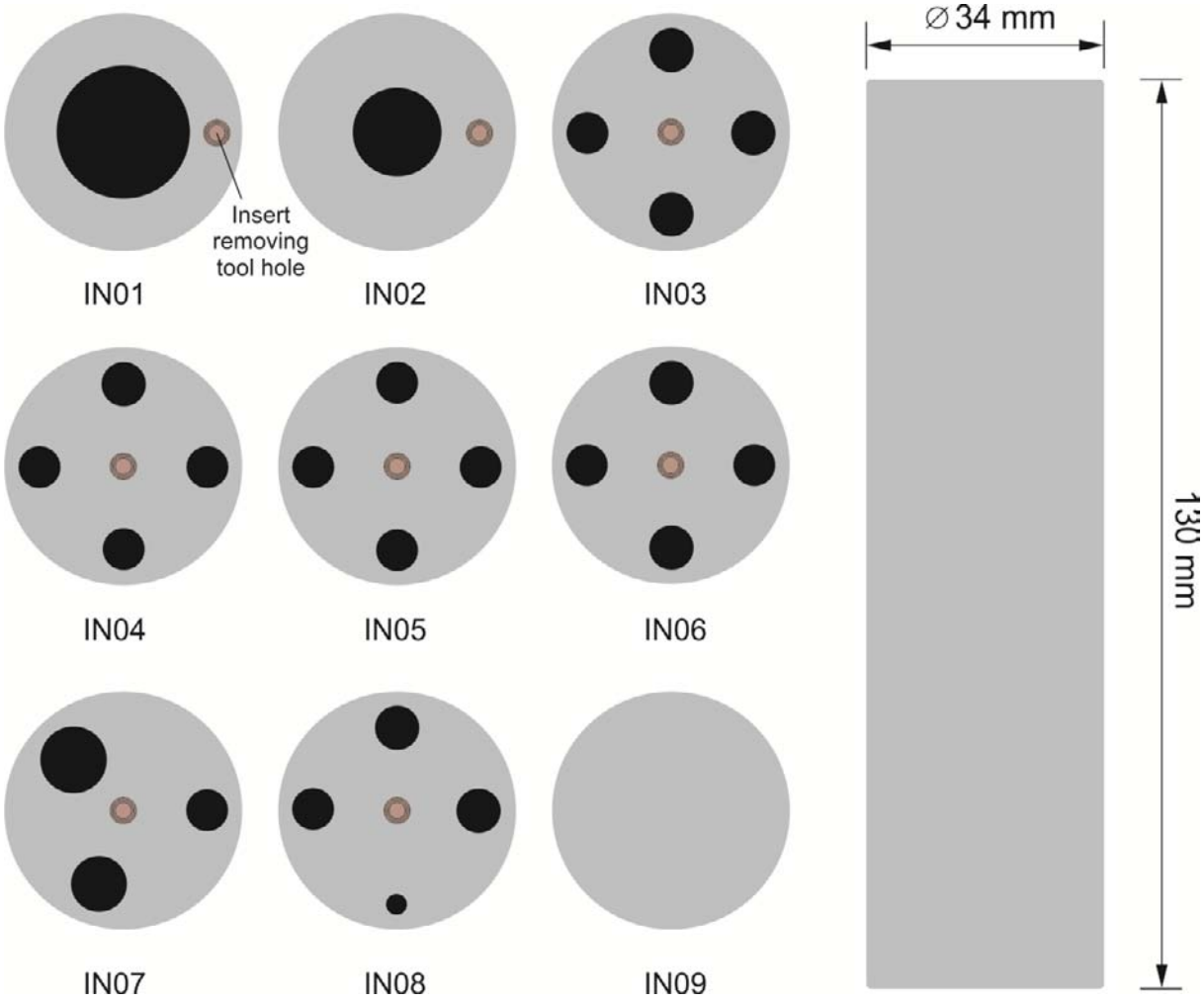
- **Insert:**

Inserts	Holes	Order Code
IN01	1 x 3/4"	06.04.0031-00
IN02	1 x 1/2"	06.04.0032-00
IN03	1 x 6.0 mm and 3 x 1/4"	06.04.0033-00
IN04	3 x 6.0 mm and 1 x 1/4"	06.04.0034-00
IN05	4 x 6.0 mm	06.04.0035-00
IN06	2 x 6.0 mm and 2 x 1/4"	06.04.0036-00
IN07	1 x 6.0 mm, 1 x 8.0 mm and 1 x 3/8"	06.04.0037-00
IN08	1 x 6.0 mm, 1 x 3.0 mm and 2 x 1/4"	06.04.0038-00
IN09	without hole, to be drilled by the client.	06.04.0039-00
IN10	Others, under ordering.	06.04.0040-00
BB	Black Body Insert kit, upper/lower thermal insulations and standard TC-N*	06.04.0074-00

* depth = 80 mm

Note: When asked, the calibration certificate will be provided for the first insert ordered.

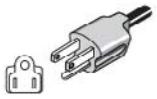
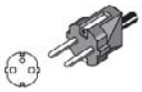
	*BB - Black Body Insert kit, upper/lower thermal insulations and thermocouple.



- **Communication Interface:**

Description	Order Code
RS-232 - 9 way D type Connector (COM1)	06.02.0002-00
RS-485	06.02.0006-00

- **Accessories:**

Description		Order Code
Soft Carrying Case for TE-1200P		06.01.1016-00
Insert Extractor		02.06.0087-20
Lead Cable Kit		06.07.0018-00
Upper Thermal Insulator		02.22.0126-21
Lower Thermal Insulator with grounding pin		02.22.0127-21
Thermal Shield		02.22.0125-21
Power Cable Type J – Brazil		01.14.0008-21
Power Cable Type B – US		01.14.0100-21
Power Cable Type F – Europe Universal		01.14.0089-21
Power Cable Type G – UK		01.14.0117-21

- **Accessories included:**

  - 01 x Insert Extractor,
  - 01 x Insert
  - 01 x Lower Thermal insulator of the insert (only one central hole);
  - 01 x Upper Thermal insulator of the insert (usually more than one hole);
  - 01 x Power cable,
  - 01 x Lead Cable Kit,
  - 01 x Technical Manual
  - 01 x Factory Calibration Certificate.

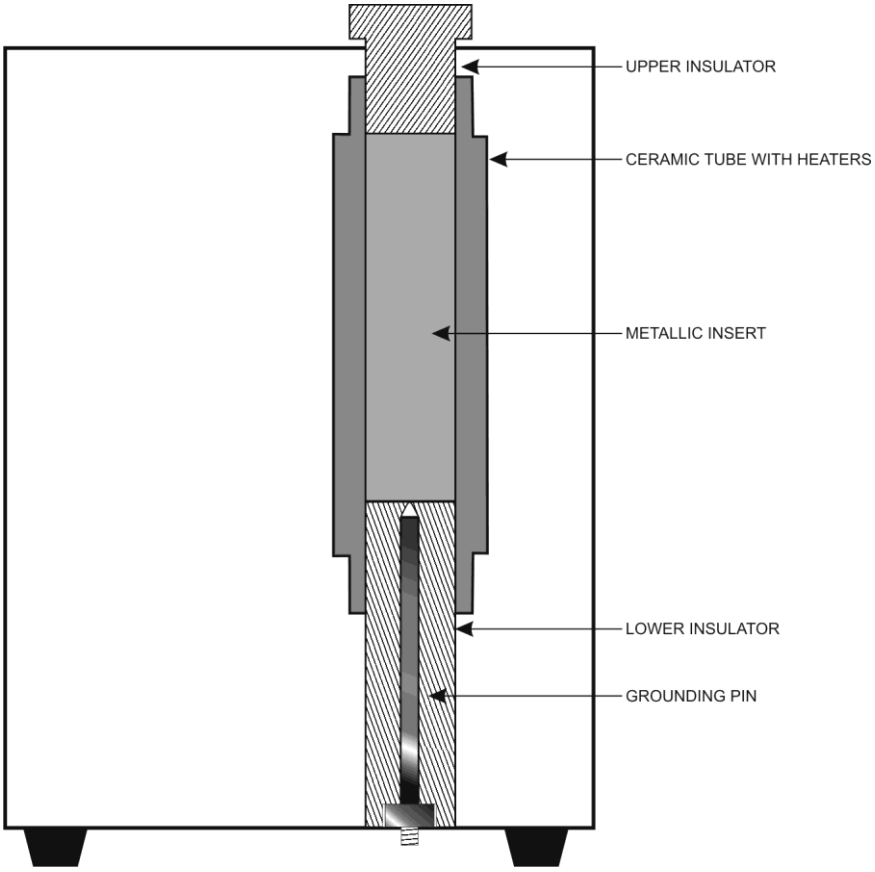
Note: When asked, the calibration certificate will be provided for the first insert ordered.

1.3 - Mounting the insert inside the furnace

Ensure furnace is cool.

In the core of the dry block TE-1200P there is a ceramic tube. Therefore, for safety purposes, the insert and the insulators are separated. To mount the set, one should first slide gently the inferior insulator inside the ceramic tube. Do not let it free, slide it inside the tube. Afterwards, hold the metallic insert by using the insert extractor and lower it inside the ceramic tube.

Finally, place the superior insulator above the insert. Note that the sensor to be tested should go through the insulator and the metallic insert to achieve a correct temperature measurement.



SCHEMATIC VIEW FOR INSERT MOUNTING

1.4 - Instruction for use of the optional Black Body insert

- **Black Body Insert - BB**

Special geometry pen type Insert and effective target ∅ 20 mm made of refractory material. Constitutes a high emissive blackbody cavity for calibration of optical pyrometers.

- **Insert of the Black Body**

  Ensure furnace is cool.

  Identify the following parts and proceed to the mounting as explained:

  - Cylindrical Thermal insulator – Mounted in the lower part of the pit of the furnace.
  - Metallic Insert type Black Body cavity – Must be introduced in the pit joined with a thermocouple type N mounted laterally.



Careful when entering the thermocouple in the cavity to not force the fragile ceramic wall pit.

  - Ring-shaped cylindrical Insulator - mounted on top of the pit of the furnace



Note that the position of the slit of insulation should match the type N thermocouple sheath laterally.

  - Connect the terminals of the thermocouple type N to the auxiliary input side of the furnace TE-1200P and set the reading of the IN input to N type thermocouple.

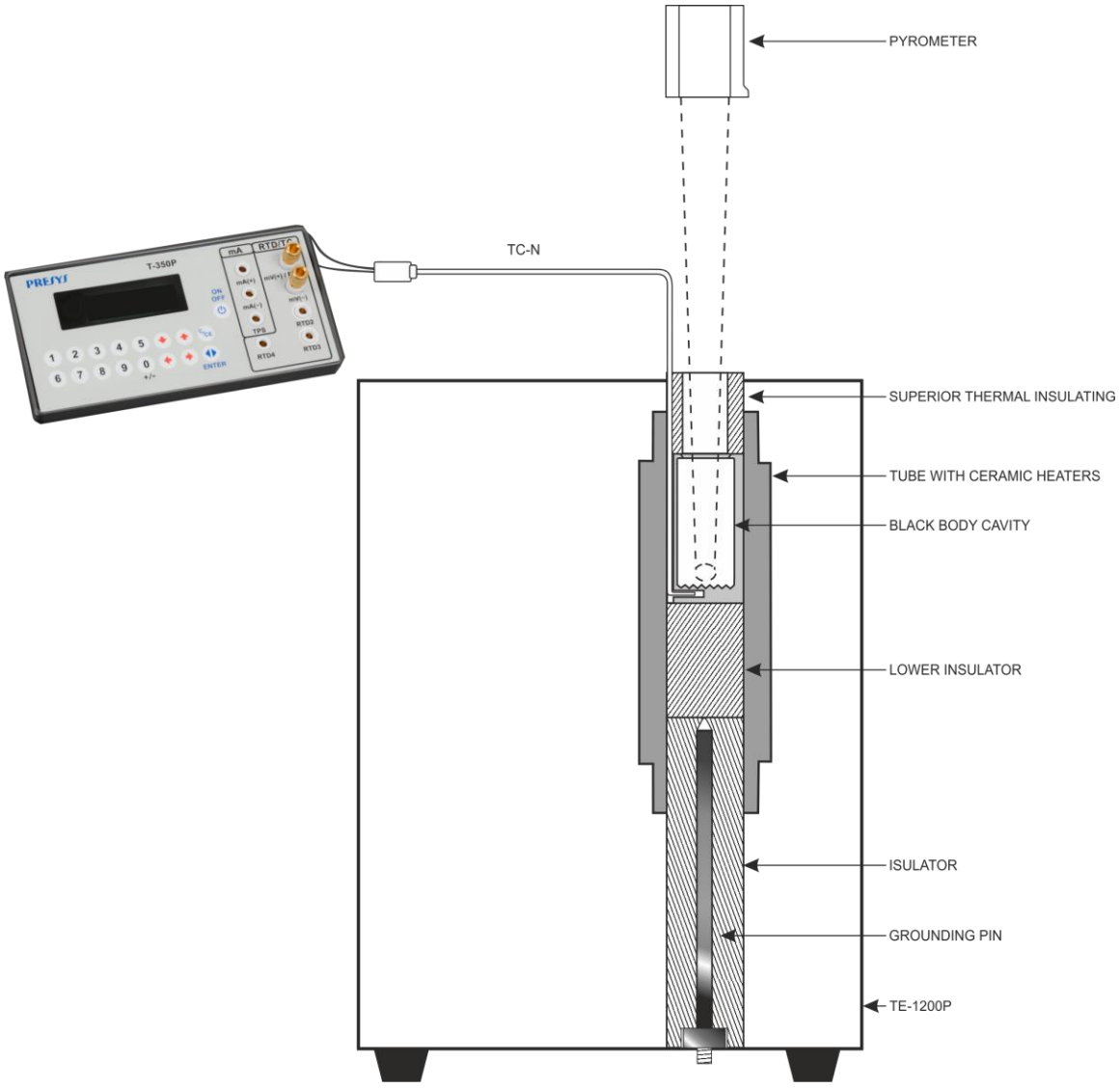
The combination constitutes an excellent mounted cavity blackbody with emissivity above 0,95 and an effective target of Ø 20 mm well suited for calibration of optical pyrometers.

Align the pyrometer to be calibrated with a black body cavity in the furnace in a vertical position.

Observe the distance of the pyrometer to be calibrated against the background of the black body cavity and the size of the actual target (Ø 20 mm) as specified in the technical manual optical pyrometer.

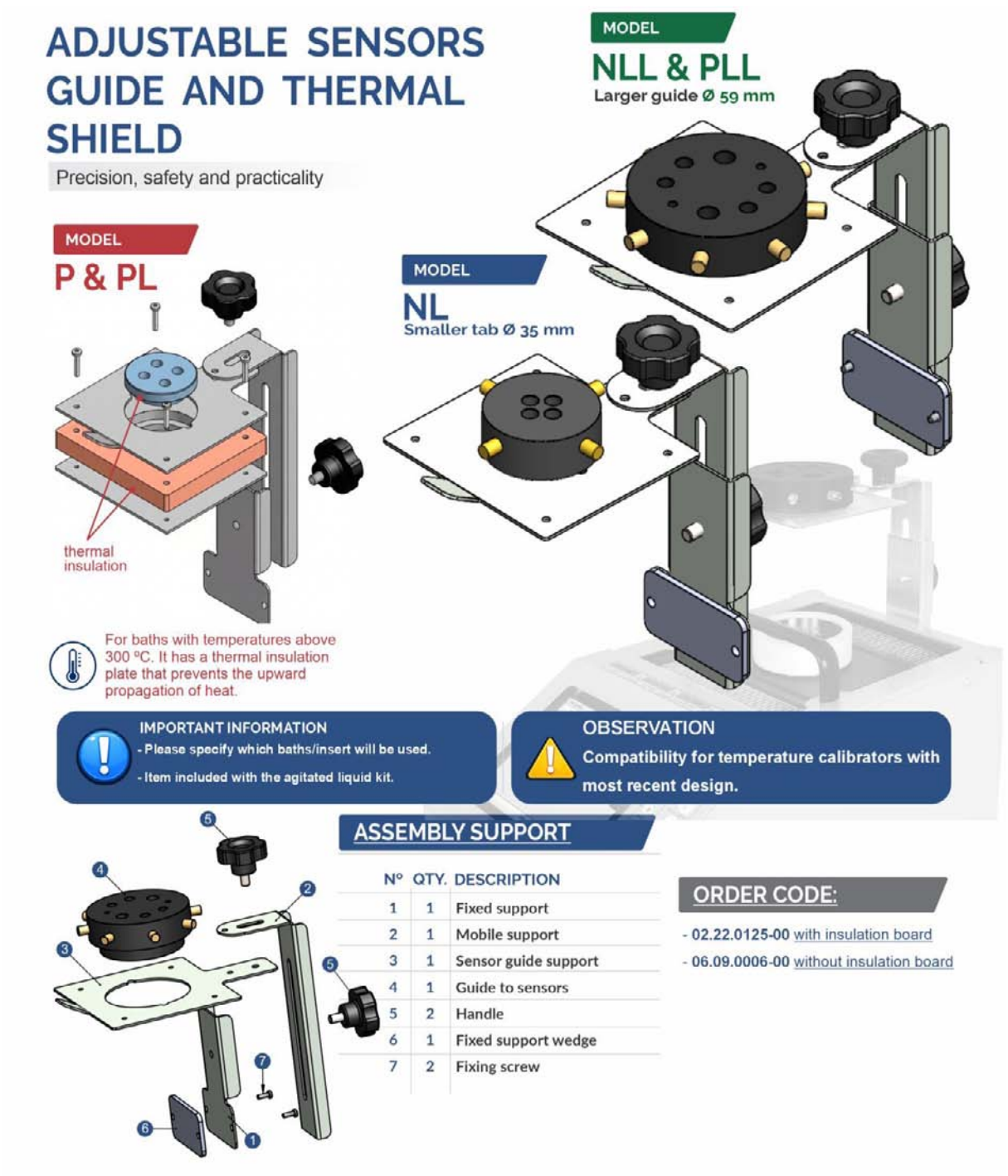
Remember that the area targeted by the pyrometer to be calibrated must be less than or equal to the effective target spot size of the blackbody in order to not introduce measurement errors.

Use the certificate of calibration of the thermocouple type N to correct the readings from the IN input of the calibrator and comparing the reading of the optical pyrometer.



SCHEMATIC VIEW FOR MOUNTING OF THE BLACK BODY CAVITY

1.5 - Sensor Guide



Nº	QTY.	DESCRIPTION
1	1	Fixed support
2	1	Mobile support
3	1	Sensor guide support
4	1	Guide to sensors
5	2	Handle
6	1	Fixed support wedge
7	2	Fixing screw

2 - TE-1200P Calibrators Operation

The TE-1200P calibrators keep the block temperature controlled and allow the reading of a thermo-element connected to its terminals. It is possible to verify the thermocouple, thermoresistances, temperature transmitters etc together with the block temperature value and temperature setpoint.

The calibrators have 3 operating modes:

- ***Manual Mode*** to select the block temperature straight from the keypad.
- ***Programmable Mode***: 6 different programs with 11 temperature setpoint values. The block temperature is selected among the programmed values by the keys ⇧ and ⇩. The *Programmable Mode with Timer* scans automatically the temperature setpoints.
- ***Automatic Mode*** to calibrate thermo-elements. The thermo-elements calibration is performed in an automatic way by the calibrator: the schedule and the calibration results, besides the thermo-element readings are stored in the calibrator memory.



When powered on (**ON/OFF** key), the calibrator goes through a self-test routine and shows the last calibration date and the value of the battery voltage. The battery voltage is constantly monitored and the low battery warning is provided. After the self-test is completed, the display shows the starting menu.

⇨ **IN**	**EXEC**	
CONF	**CAL**	**COM**

The initial setpoint is 50.00 ºC:

By means of keys ⇧, ⇩, ⇦ and ⇨, choose the menu options and press **ENTER**.

IN: selection of the calibrator signal input. Choose among mV, Ohms, thermocouples, thermoresistances, mA, switch or none. More details in item *2.1 - Menu IN*.

EXEC: The calibrator enters the manual or programmable operating mode.

CONF: Accesses the calibrator configuration options. More details in item *2.2 - Menu CONF*.

CAL: This option accesses the TE-1200P calibrator adjust functions, protected by password. More details in section *7 - Calibration*.

COM: Accesses the automatic calibration parameters. It is possible to perform a calibration without a computer or using it (via ISOPLAN software). More details in item *2.5 - Automatic Operating Mode*.

2.1 - Menu IN

⇨ **mV**	**OHM**	**TC**	
RTD	**mA**	**SW**	**NO**

mV, **mA**, **SW**: selects millivolt, milliampere or switch input, respectively.
OHM: selects ohms input. Following, choose from the menu the wiring in 2, 3 or 4-wire.

⇨ **2-WIRE**	**3-WIRE**
4-WIRE	

TC: selects thermocouple input. Choose among the **B**, **J**, **K**, **N**, **R** and **S** types. In the next menu, the internal or manual cold junction compensation is chosen.

⇨ **INTERNAL**
MANUAL

If the internal compensation is selected, the cold junction temperature value is displayed by the calibrator. If the **MANUAL** option is selected, the cold junction must be supplied by the operator. After confirming the value, by pressing **ENTER**, the calibrator goes back to the operating mode.

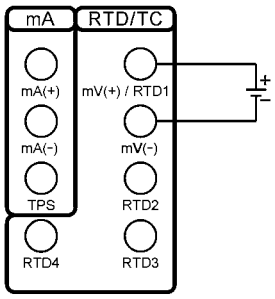
RTD: Selects the type of thermoresistance used. Choose from **PT100**, **NI100**, **CU10** and **PT1000** types. Choose also if the wiring is 2, 3 or 4-wire.

NO: Disables reading of external signal.

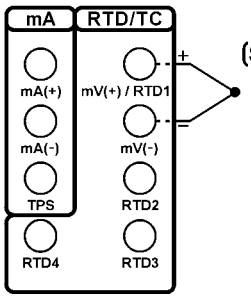
Selecting one of the options above, the calibrator goes straight to the manual operating mode, with no need to select the **EXEC** option.

2.1.1 - Input Connections Diagrams

Millivolts



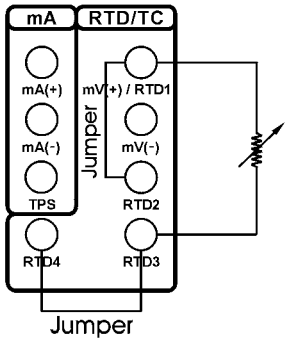
Thermocouple (TC)



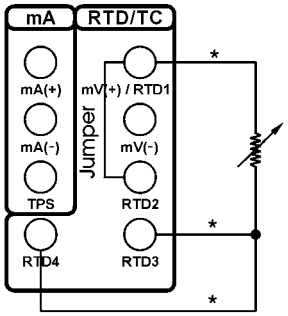
(side connection)

Use TC compensation wires.

Ohm / RTD (2-wire)

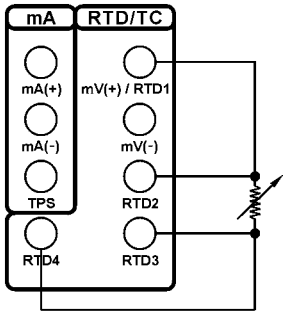


Ohm / RTD (3-wire)

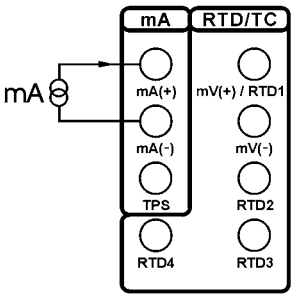


(*) Use same gauge and length wires

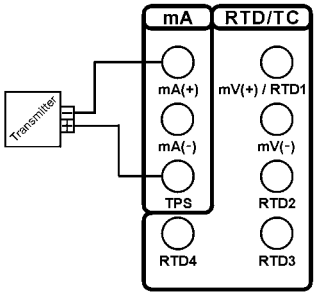
Ohm / RTD (4-wire)



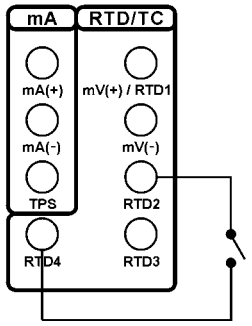
mA



mA with power supply



Switch (SW)



2.2 - Menu CONF

⇨ CF	PRG	MEM		DSP
SC	BT	DT	BZ	TU

CF: Selects the temperature unit between ºC or ºF. The ITS-90 or IPTS-68 temperature scales are selected for both the thermo-element and for the internal block reference readings purpose.

⇨ ºC-90	ºF-90
ºC-68	ºF-68

DSP: This option sets the OLED display contrast. Use the keys ⇧ and ⇩ until you get a better contrast and finish the operation by pressing the key ENTER.

BT: Shows the battery or the battery charger voltage value if the dry block is turned off or on, respectively.

Battery level	Battery state	Display
4.0 to 7.0 V	normal	----------
< 4.0 V	low	LOW BATTERY

DT: Updates the date and time of the calibrator. Thus, when the calibrator performs a calibration in the automatic mode via Isoplan®, all data are registered together with date and time of occurrence. Every time the calibrator is powered off, the internal clock does not continue to be updated. However, the Isoplan® software can automatically update the calibrator date and time with the computer internal clock. Otherwise, use keys ⇧ and ⇩ to change the field that blinks and the keys ⇨ and ⇦ to go to another field. The key **ENTER** confirms the last selection.

BZ: Menu that configures the piezoelectric buzzer.

⇨ NO	YES	ENDCAL

NO: Disables the buzzer.

YES: The buzzer beeps when the block reaches the setpoint and stabilizes.

ENDCAL: The buzzer beeps only at the end of a calibration in the automatic operating mode.

TU: Menu that configures the PID control parameters for the heating side.

More details in section *6 - PID Control Parameters*.



⇨ K	I	D	FACT

K: Proportional gain

I: Integral gain

D: Derivative gain

FACT: Restore the control parameters to the factory values.

PRG: Menu that programs the calibrator.

⇨ DEC_IN	DEC_PRB
SETPOINT	

DEC_IN: Selects the number of decimals of the thermo-element reading. The default value depends on the input signal.

⇨ DEFAULT				
0	1	2	3	4

DEC_PRB: Selects the number of decimals of the block temperature and the setpoint value. The default number is 2.

0	1 ⇨	2

SETPOINT: Enables the calibrator *Programmable Operating Mode*, and allows the configuration of programmed values. The selected program is indicated by the selection arrow. Choose one of the **6** temperature programs or **NO** to disable this *Programmable Mode*.

Select any of the 6 programs and confirm with the key **ENTER.** Following, it is shown the menu of temperature setpoint configuration.

⇨ 10%	20%	25%
VARIABLE		

Change the configuration to steps (STEPS) of **10%**, **20%**, **25%**, **VARIABLE** or press **C/CE** to maintain the configuration already stored in memory. The temperature range of the program must be configured through the values in **SETPOINT HIGH** and **SETPOINT LOW** in case of **10%**, **20%** or **25%** fixed steps of the range. The option **VARIABLE** allows the user to define from 2 to 11 values of temperature setpoint, not necessarily in ascending order.

To verify the step values of a program, select the **VARIABLE** option and confirm the values shown in the display with the key **ENTER**. The **10%**, **20%** and **25%** options change the number of steps automatically and recalculate the values according to **SETPOINT HIGH** and **SETPOINT LOW**.

SC: This function scales the input reading. The scaling is very useful in temperature transmitter calibration, for instance, because it displays the current temperature and the transmitter reading (mA) in the same unit. Thus, the error can be verified directly in ºC or ºF. Select the option **SC** and press **ENTER**. If no input is selected in **IN**, the calibrator will show the **SELECT INPUT FIRST** message. In this case, go to menu **IN** and select the input signal type.

The function **SC** will show **IN** or **NO.** Confirm **IN** to configure the scaling or **NO** to disable the **SC** function, with the key **ENTER**.

The scaling is performed via the **INPUT HIGH** and **INPUT LOW** parameters, corresponding to the maximum and minimum values of the calibrator signal input, in the engineering unit of this signal. Next, configure the **SCALE DEC (0-4)**, **SCALE HIGH** and **SCALE LOW** parameters according to the maximum and minimum values of the transmitter scale and the desired number of decimals. The scaled value is shown on the display with the # unit.

For example, temperature transmitter with 0 to 100 ºC input and 4 to 20 mA output. The scaling with one decimal would be:

INPUT HIGH: 20.0000 mA
INPUT LOW: 4.0000 mA
SCALE DEC (0-4): 1
SCALE HIGH: 100.0 #
SCALE LOW: 0.0 #

MEM: The TE-1200P calibrators allow many special programs and functions that can be of frequent use. In situations like this, it would be useful to store the current configuration in memory in order to save time. Up to 8 configurations can be stored in memory.

Selecting the option **MEM**, it is possible to store the current configuration (**WRITE**), restore a previous stored configuration (**RECALL**) or erase the 8 configurations from memory (**CLEAR ALL**).



Selecting the option **WRITE** or **RECALL** will present a new menu with numbers 1 to 8, representing each one of the memory positions. Choose one of the positions and press **ENTER**. The writing operation (**WRITE**) can be made in an already used memory position. The calibrator asks for the overwriting confirmation with the message **OVERWRITE MEMORY?**. The **CLEAR ALL** operation shows a confirming message **ARE YOU SURE?**. In both cases, press **ENTER** to confirm the operation or **C/CE** to cancel.

2.3 - Manual Operating Mode

The display shows the selected temperature value of the block and also the current block temperature or thermo-element temperature value.

There are 4 ways in which the information are shown, covering the calibrator input value (**IN**), the block temperature (**PROB**) and the temperature setpoint (**SET**). The key ⇦ interchanges the display presentation way:

IN = 23.456 mV **PROB= 300.0 ºC**
PROB= 300.1 ºC **SET = 300.0 ºC**
23.456 **IN = Voltage (mV)**
300.1 **SET = 300.0 ºC**

The block temperature setpoint is selected directly by the keypad, even if the message **SET** is not being displayed. The numeric keypad enables the **SET** selection in any of the display presentation ways, to change the setpoint.

The setpoint value is increased by key ⇧ and decreased by key ⇩. While the keys are kept pressed, the setpoint continues to be increased or decreased.

The key ⇨ does not have function in the manual operating mode of the TE-1200P calibrators.

Intermally, the setpoint changes at a limited rate to make possible a safer and more homogeneous heating of the internal ceramic tube. Besides, the PID parameters and algorithm were adjusted to assure a minimal stabilization time and overshoot.

2.4 - Programmable Operating Mode

Pre-configured programs can be loaded from the calibrators memory, enabling the programmable operating mode. The temperature programmed values of the block are used directly, with no need to enter the setpoint.

The display shows **STEPn** beside the block temperature setpoint value in the programmable mode. The number of the program is indicated by **n**. Using the keys ⇧ and ⇩, the programmed values of temperature setpoint are changed. The numeric keypad continues available for manual selection of the block temperature in the same way of the manual operating mode.

The automatic scan over the programmed temperatures is implemented by defining the stabilization time of the thermo-element in the block.

The key ⇨ enables the automatic scan over the points. When pressed, the message **STEPn** gives place to **0s** and the calibrator waits for the stabilization time

configured from 1 to 9 minutes, by the keys **1** to **9**. The automatic scan is disabled by pressing key ⇨ again.

A countdown of the stabilization time is only started when the block temperature reaches the programmed temperature and stabilizes within a range of approximately ±0.20 ºC. At this time the buzzer beeps, in case it is configured to **YES**.

2.5 - Automatic Operating Mode 

The thermo-element calibration is performed in an automatic way by the TE-1200P calibrators. The configuration, as well as the calibration verification is carried out by the calibrator itself. Also it is possible to use the ISOPLAN® software and its work orders, like a CAC - Computer Aided Calibration.

The independent automatic calibration, without the use of ISOPLAN®, is planned in the option **TAGMAN** from menu **COM**.

TAG	**EXEC**	**VERIF**
ADDRESS		**⇨ TAGMAN**

Before you start programming, configure first the signal that will be read by the calibrator in the menu **IN**. To calibrate glass thermometers, for example, there is no electric signal to be read. In this case, option **IN** from the menu must be configured to **NO** and the calibrator will ask to enter the value indicated by the thermometer, at the end of the stabilization time of each calibration point.

The data for an automatic calibration concern:

- **TAG**: the thermo-element tag identification.
- **SP**: the block temperature reference values for the calibration (calibration points).
- **TOL**: the maximum tolerance for the thermo-element operation.
- **STB**: the stabilization time, in seconds, so that the thermo-element temperature indicates correctly. This timer starts just after the block reaches and stabilizes at the setpoint temperature.
- **STR**: the calibration strategy of the programmed reference values. The available strategies are: ⇧ (UP), ⇩(DOWN), ⇧⇩ (UP - DOWN), ⇩⇧ (DOWN - UP), ⇧⇩⇧ (UP - DOWN - UP) and ⇩⇧⇩ (DOWN - UP - DOWN).
- **RP**: the strategy number of repetitions.
- **RGI**: the thermo-element indication range.
- **RGO**: the operating temperature range that corresponds to the indication range above.

The automatic calibration begins when the option **EXEC** from menu **COM** is selected. All the operations are automatically performed by the TE-1200P calibrators. The keypad does not work until the end of the calibration.

At the end of the stabilization time, the calibrator stores the thermo-element reading in memory and goes to the next point, in case some input signal has been previously configured in the menu **IN** and connected to the calibrator terminals.

The **CALIBRATION END** message appears on the display at the end of the automatic calibration. Press **ENTER** to confirm. The results can be verified in option **VERIF** from menu **COM**.

The first message in option **VERIF** informs the calibration result, with the number of points that have succeeded. Following, press **ENTER** to verify each one of the readings performed by the calibrator. The keys ⇨ and ⇦ interchange 2 screens: one that displays the block and thermo-element temperature value and the other displays a message indicating the calibration point number and its state (**OK** or **FAIL**), besides the error value in %.

The option **TAG** from menu **COM** can present a list of up to 4 tags that have been downloaded or uploaded with ISOPLAN® software. The key **ENTER** selects the tag to be calibrated from the tag list. The automatic calibration starts by the option **EXEC** from menu **COM** and the calibration data can be verified in option **VERIF**. To calibrate automatically not using the Isoplan, there is a reserved place for one manual tag. The selection of the manual tag is performed by confirming the option **TAGMAN** with the key **ENTER**.

The option **ADDRESS** selects the communication address of the TE-1200P calibrator. The communication protocol used is ModBus - RTU, with no parity and baud rate of 9600. The calibrator communication with the computer can use RS-232 or RS-485, for network option, according to the communication interface used. In order to communicate with ISOPLAN® software, configure **ADDRESS** to 1.

3 - Recommendations as regards Accuracy of Measurements



PRESYS dry block temperature calibrators are instruments of high accuracy level, requiring the observation of all the procedures described in this section, in order to achieve the necessary conditions to get the accuracy levels during the calibrations.

- Special attention should be paid in relation to the insert cleanliness. When necessary, it should always be washed with water and soap, well rinsed and dried. Oil, grease, solid particles can hinder the heat transference to the insert and even jam the insert inside the block.

- The sensor to be calibrated must fit snugly into the appropriate well. In case the sensor is loose, the measurement accuracy meaning can be completely senseless. The meaning of clearance between the sensor and the respective well should be understood in a subjective way and the common sense is very important. Thus, the sensor should enter the insert well (both completely clean) in such a way to stay snugly enough so that it can not move or swing inside but it should not enter by force to get jammed.

3.1 - Getting a Better Accuracy from the Dry Block

The temperature control is based in the temperature measurement of an internal sensor placed in the block.

This control probe is adjusted in factory by means of another sensor with high accuracy (probe) connected to a superthermometer, as described in item *7.2 - Probe Calibration*. So, at factory, the accuracy of the superthermometer is transferred to the dry block calibrator. The transference will be well performed only when there is a perfect temperature equilibrium between the internal control sensor and the superthermometer probe. Therefore, it should not have any clearance between the insert and the block or between the probe and the insert. Both the internal sensor and the probe should also be at the same depth.

The user will get the best accuracy from the dry block, provided in this technical manual, in case one succeeds in reproducing the same conditions of the factory adjustment, that is, the same insert used in factory, no clearance, same depth etc.

Summing up, the important thing to get the best accuracy from the dry block is to reproduce the process used by the factory to adjust the dry block itself.

When a higher accuracy than that mentioned in the technical manual is necessary, one should use an external superthermometer as a reference or standard to compare with the thermo-element under calibration.

In this case, the dry block is only used as a heat generator, not as a standard temperature calibrator. The user can use the fact that the dry block stability value is much lower than its accuracy value. So, placing the superthermometer sensor and the thermo-element under calibration in a two-hole-insert, it is possible to compare both temperature measurement.

4 - Safety Instructions 

- If the calibrator is turned on, do not leave the room without an identification or warning about the high temperature hazard.
- Before turning the calibrator off, return the block temperature to values close to the ambient temperature.
- Never remove the insert from the dry block or the thermo-elements from the insert, while they are in temperatures far from the ambient. Wait until they reach the ambient temperature.
- Never transport the dry block with the metallic insert inside it, as the metallic insert can hit the ceramic tube damaging it permanently.

5 - Calibrator Warning Messages 

Warning	Meaning	Procedure
RAM ERROR READ MANUAL	Problem in RAM memory	Turn the calibrator off and on. If the error persists, send the instrument to the factory
EEPROM ERROR READ MANUAL	Problem in EEPROM memory	Same as the previous item
LOW BATTERY	Level of battery voltage is low	Check the TE-1200P calibrator power supply
UNDER / OVER	Input signal out of specifications or scaling range	See item 1.1.1 on Input Specifications
????.??ºC	Input sensor is open	Check input connections and sensor

6 - PID Control Parameters 

The TE-1200P temperature calibrators have a PID control algorithm to calculate the block control output.

The dry block stability and response time features are related to the PID parameters, explained below:

The K parameter (proportional gain) amplifies the error signal between the setpoint and the block temperature to establish the output signal. When this parameter is very high, the output reaction is very quick, however this can take the system into oscillation. Decreasing this parameter, the dry block would not be able to react quickly enough to external variations, giving the impression of a sudden out of control.

The I parameter (integral gain) is responsible for the integral action and it is the most important part in the setpoint control. While an error persists between the setpoint and the block temperature, the integral action will actuate on the output signal until the error is brought to zero.

The D parameter (derivative gain) is responsible for the derivative action that provides a quick response at the control output resulting from any rapt variation in the block temperature. It is used to eliminate oscillations. However, it can cause oscillations in the presence of much noise.

All temperature calibrators are tuned in factory and the parameters are close to the optimum ones. In case one wants to improve a specific feature of the calibrator (stabilization time or response time, for instance), make sure the alteration is made reasonably.

7 - Calibration (Adjustment)



ATTENTION: The password required for the adjustment procedures (entry/exit) is available on the White label located on the back of the instrument.

Warning: Enter the following options only after understanding them completely. Otherwise, it may be necessary to return the instrument to the factory for recalibration!

Select **CAL** option from the menu and press the **ENTER** key. You should then enter the password (**PASSWORD**) to access the calibration menu.

The password functions as a protection to calibration ranges. After the passowrd is entered, the menu displays the options:

⇨ IN	OUT	DATE

You should then choose the input range (**IN**) as the output range (**OUT**) is not available for the user. **DATE** is an option which allows you to record the date on which the calibration was performed and once it has been filled in, it will be displayed every time the calibrator is turned on.

Options for **IN** calibration are:

⇨ mV	mA	OHM	CJC
PROBE			

7.1 - Input Calibration

Select the corresponding mnemonic and apply the signals presented in the tables below.

When calibrating inputs, the display shows on the 2nd line the value measured by the calibrator and on the 1st line the same value is expressed as a percentage.

Note that the applied signals just need to be close to the values shown in the table.

Once the signal has been applied, store the values of the 1st and 2nd calibration points, by pressing keys 1 (1st point) and 2 (2nd point).

mV Input	1st point	2nd point
G4	0.000 mV	70.000 mV
G3	0.000 mV	120.000 mV
G2	0.000 mV	600.000 mV
G1	600.000 mV	2400.000 mV

mA Input	1st point	2nd point
Single range	0.0000 mA	20.0000 mA

Input calibration for Ω is performed in two steps:

a) Application of mV signal:
For the calibration below, leave terminals RTD3 (+) and RTD4 (+) short-circuited.

mV Signal	Terminals	1st point	2nd point
V_OHM3	RTD3(+) and mV(-)	90.000 mV	120.000 mV
V_OHM4	RTD4(+) and mV(-)	90.000 mV	120.000 mV

b) Application of standard resistors:
Connect a decade box or standard resistors on terminals RTD1, RTD2, RTD3 and RTD4 (4-wire connection).

resistors	1st point	2nd point
OHM3	20.000 Ω	50.000 Ω
OHM2	100.000 Ω	500.000 Ω
OHM1	500.000 Ω	2200.000 Ω

The cold junction calibration (CJC) is performed measuring the mV(-) terminal temperature. Store only the 1st point.

Cold Junction	1st point
CJC	32.03 ºC

7.2 - Probe Calibration

The options of calibration / probe are:



ºC: Adjust of the internal temperature sensor (internal Probe).

RESTORE: Restores the internal temperature sensor calibration parameters to the factory values.

To readjust the internal Probe it is necessary to compare the value indicated by the calibrator (Probe) and the temperature value from an external probe placed in the dry block insert. The temperature of the external probe should have high accuracy and should be measured by a superthermometer (ST).

The option to adjust the internal sensor has seven points of adjustment. These points are recorded via keys 1 to 7.

Before starting the calibration (adjustment), record in these points the respective initial storing values, according to the table below.

Go to the manual operating mode (menu **EXEC**) and generate all the seven levels of temperature (setpoints from the table), writing down the value indicated by the

superthermometer (ST). Now, go back to the option Calibration/ Probe / ºC and record the values indicated by the superthermometer.

For TE-1200P:

Setpoint of the temperature generated (ºC)	Initial value to record (ºC)	ST indication	New value to record	New indication of the ST	key
150	150.0	149.96	150.0	150.01	key 1
350	350.0	349.93	349.9	349.99	key 2
600	600.0	598.03	598.0	600.02	key 3
750	750.0	745.32	745.3	749.99	key 4
850	850.0	843.13	843.1	850.03	key 5
1000	1000.0	990.45	990.4	999.97	key 6
1100	1100.0	1087.11	1087.1	1100.05	key 7

8 - Maintenance

8.1 - Instructions for Hardware 

There are no parts or components in the TE-1200P temperature calibrators that can be repaired by the user. Only the 10 Amp fuse for 115V or 230V models, placed within the socket on the rear can be replaced in case of blow.

The fuse may blow due to a voltage spike in the mains or a calibrator component fault. Replace the fuse once. If a second fuse blows again, it is because the fault is not that simple. Send the calibrator to the factory for repair.